Notice of Allowability	Application No. 10/764,634	Applicant(s) WILLIAMS, JERRY GENE	
	Examiner Juan D. Valentin II	Art Unit 2877	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *04/26/2007*.
2. ☒ The allowed claim(s) is/are *43-71*.
3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the:
   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
   1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

DETAILED ACTION

EXAMINER'S AMENDMENT

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Jerry Gene Williams on June 19, 2007.

The application has been amended as follows:

- Claims 14-42 has been canceled.
- Claims 43-71 have been added.

43. A method for determining the vibration characteristics of long slender structures using maximum bending strain measurements of said long slender structures subjected to dynamic disturbances imposed by water or wind generated dynamic loads, otherwise known as vortex induced vibrations (VIV), comprising:

projecting laser light into a single or plurality of independent optical fiber(s) fastened at discrete locations along the longitudinal axis of said long slender structure;

reflecting said projected laser light from optical reflective interfaces placed at discrete length segments along the length of each optical fiber in turn creating a reflected laser light data signal;

collecting through a fiber optics or electronic data transmission link said reflected laser data signal;

receiving and analyzing said collected laser light data signal at electronic optical signal monitoring instrumentation;

determining critical bending strains within said discrete length segments along the length of said long slender structure; and

calculating at least one of said vibration characteristics of said long slender structure from the determined critical bending strains in order to permit mitigation of damaging effects caused by VIV along said long slender structure through the use of corrective action.

44. The method of claim 43, wherein vibration characteristics include: vibration frequency, vibration amplitude, node-to-node wavelength, and the magnitude of the imposed peak bending strains.

45. The method of claim 43, further comprising:

locating the optical fiber(s) along the longitudinal axis and near the exterior or interior surface of said long slender structure.

46. The method of claim 43, further comprising:

locating the optical fiber(s) at opposite ends of an imaginary line drawn perpendicular to the longitudinal axis of said long slender structure and through said long slender structure centroid thereby enabling the measurement of said critical bending strains imposed during dynamic loading.

47. The method of claim 43, further comprising:

locating multiple sets of longitudinally oriented optical fibers on said long slender structure near opposite ends of an imaginary line drawn perpendicular to the longitudinal axis of said long slender structure and through said long slender structures centroid designed to capture the maximum bending strains imposed during dynamic loading.

48. The method of claim 43, used to measure said bending strains imposed by VIV experienced by metal or composite production and drilling risers, tubing, ropes, and cables deployed in offshore operations in the oil industry.

49. The method of claim 43, further comprising:

providing said calculated vibration characteristic information to offshore petroleum drilling and production operations; and

using said calculated vibration characteristic information to permit mitigation of potentially damaging effects of VIV in said long slender structure by the adjustment of the axial tension in said long slender structure and the addition of strakes, shrouds, and fairings to said long slender structure.

50. The method of claim 43, wherein said electronic optical signal monitoring instrumentation is capable of measuring the time of flight of light reflected from said optical interfaces;

using said time of flight information to determine said critical bending strains.

51. The method of claim 50, wherein said electronic optical signal monitoring instrumentation is optical time domain reflectometry instrumentation.

52. The method of claim 43, wherein said electronic optical signal monitoring instrumentation is optical frequency domain reflectometry instrumentation.

53. The method of claim 43, further comprising:

positioning said optical fiber(s) along the longitudinal axis of said long slender structure so as to traverse back and forth between opposite ends of said discrete length segments of said long slender structure along said longitudinal axis to provide greater sensitivity to the measurement of said critical bending strains through the use of time of flight instrumentation.

54. The method of claim 43, wherein the electronic optical signal monitoring instrumentation measures said critical bending strains using Bragg diffraction gratings.

55. The method of claim 43, further comprising:

rigidly attaching said optical fiber(s) to the exterior or interior surface of a metal or composite tubular within said long slender structure using a bonding agent; and

protecting said rigidly attached optical fiber(s) from damage by hazards imposed in the operating environment by a polymeric or elastomeric external layer.

56. The method of claim 43, wherein said optical fiber(s) used to measure said critical bending strains are constructed of glass or plastic.

57. The method of claim 43, wherein said long slender structures are either a rope or cable;

said determined bending strains and said calculated at least one vibration characteristic provide information needed to take action to permit mitigation of the potentially damaging effects of wind or water generated dynamic disturbances.

58. A method for measuring the bending and buckling characteristics of spoolable metal or composite pipe subjected to axial compressive loading during injection into a small diameter annulus, comprising:

projecting laser light into a single or plurality of independent optical fiber(s) fastened at discrete locations along the longitudinal axis of said spoolable metal or composite pipe;

reflecting said projected laser light from optical reflective interfaces placed at discrete length segments along the length of each optical fiber in turn creating a reflected laser light data signal;

collecting through a fiber optics or electronic data transmission link said reflected laser data signal;

receiving and analyzing said collected laser light data signal at electronic optical signal monitoring instrumentation;

determining critical bending strains within said discrete length segments along the length of said spoolable metal or composite pipe; and

calculating at least one bending and buckling characteristic of said spoolable metal or composite pipe from the determined critical bending strains to allow for corrective action to be taken to prevent helical buckling lock-up of said spoolable metal or composite pipe in said small diameter annulus.

59. The method of claim 58, further comprising:

locating the optical fiber(s) at opposite ends of an imaginary line drawn perpendicular to the longitudinal axis of said spoolable metal or composite pipe and through said spoolable metal or composite pipe centroid thereby enabling the measurement of said critical bending strains imposed during injection of said spoolable metal or composite pipe into said small diameter annulus.

60. The method of claim 58, further comprising:

locating multiple sets of longitudinally oriented optical fibers on said spoolable metal or composite pipe near opposite ends of an imaginary line drawn perpendicular to the longitudinal axis of said spoolable metal or composite pipe and through said spoolable metal or composite pipe centroid designed to capture the maximum bending strains imposed during injection of said spoolable metal or composite pipe into said small diameter annulus.

61. The method of claim 58, further comprising:

measuring said critical bending strain in said spoolable metal or composite pipe as said spoolable metal or composite pipe buckles into numerous short wavelength spiral and helical buckles inside said small diameter annulus in response to an axial compressive force imposed to push the spoolable pipe into the annulus by a coiled tubing injector or other injunction apparatus.

62. The method of claim 58, further comprising:

providing said bending and buckling characteristic information to petroleum drilling and production operations; and

using said calculated bending and buckling characteristic information to prevent said spoolable metal or composite pipe from entering a condition of lock-up inside said small diameter annulus by reducing the applied axial compression force to said spoolable metal or composite pipe.

63. The method of claim 58, wherein said electronic optical signal monitoring instrumentation is optical time domain reflectometry strain instrumentation.

64. The method of claim 58, wherein said electronic optical signal monitoring instrumentation is optical frequency domain reflectometry strain instrumentation.

65. The method of claim 58, wherein said electronic optical signal monitoring instrumentation is Bragg diffraction grating strain measurement instrumentation.

66. The method of claim 58, further comprising:

positioning said optical fiber(s) along the longitudinal axis of said spoolable metal or composite pipe so as to traverse back and forth between opposite ends of said discrete length segments of said spoolable metal or composite pipe along said longitudinal axis to provide greater sensitivity to the measurement of said critical bending strains through the use of time of flight instrumentation.

67. The method of claim 58, further comprising:

rigidly attaching said optical fiber(s) to the exterior or interior surface of said spoolable metal or composite pipe using a bonding agent; and

protecting said rigidly attached optical fiber(s) from damage by hazards imposed in the operating environment by a polymeric or elastomeric external layer.

68. The method of claim 58, further comprising:

locating the optical fiber(s) along the longitudinal axis and near the exterior or interior surface of said spoolable metal or composite pipes.

69. The method of claim 58, further comprising:

integrating said optical fiber(s) to the interior of said spoolable metal or composite pipe following said spoolable metal or composite pipe fabrication;

said optical fiber integration method comprising:

inserting a cylindrical foil carrier consisting of an outer layer of adhesive;

attaching said optical fibers longitudinally into said foil carrier;

pressurizing the interior of said foil carrier with a hot fluid or gas in order to cure said adhesive to bond said foil carrier to said spoolable metal or composite pipe.

70. The method of claim 58, further comprising:

integrating said optical fiber(s) into the body of said spoolable metal or composite pipe during manufacture.

71. The method of claim 58, further comprising:

carrying out said critical bending strain measurements of said spoolable metal or composite pipe in a region of deployment onto and off of a storage spool;

providing said measured critical bending strain information in order to asses the structural integrity of the spoolable metal or composite pipe.

Allowable Subject Matter

2. Claims 43-71 are allowed over prior art of record.

The following is a statement of reasons for the indication of allowable subject matter:

Regarding claim 43, the prior art fails to disclose or make obvious "determining critical bending strains within said discrete length segments along the length of said long slender structure, and calculating at least one of said vibration characteristics of said long slender structure from the determined critical bending strains" and in combination with the other recited limitations of claim 43. Claims 44-57 are allowed by virtue of dependency on the allowed claim 43.

Regarding claim 58, the prior art fails to disclose or make obvious "determining critical bending strains within said discrete length segments along the length of said spoolable metal or

composite pipe, and calculating at least one bending and buckling characteristic of said spoolable metal or composite pipe from the determined critical bending strains" and in combination with the other recited limitations of claim 58. Claims 59-71 are allowed by virtue of dependency on the allowed claim 58.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Juan D. Valentin II whose telephone number is (571) 272-2433. The examiner can normally be reached on Mon.-Fri..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory J. Toatley, Jr. can be reached on (571) 272-2800 ext. 77. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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